DOCUMENT RESUME

ED 298 883 IR 012 349

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TITLE Technology: Developing Our Newest and Greatest Resource.
PUB DATE 19 Apr 84
NOTE 16p.; Paper presented at the National Conference on Technology and Education (Fort Worth, TX, April 19, 1984).
PUB TYPE Viewpoints (120) -- Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Basic Skills; Computer Literacy; Demonstration Programs; *Educational Improvement; *Educational Technology; Elementary Secondary Education; Federal Programs; *Futures (of Society); *Government Role; Labor Needs; *Microcomputers; *Research Projects; Teacher Education; Word Processing
IDENTIFIERS National Diffusion Network; Office of Educational Research and Improvement

ABSTRACT

Pointing out the dilemmas facing educators today in preparing people for the future, this paper discusses the supply and demand nature of the job market and the growing need for better educational opportunities, and describes opportunities provided by the concept of the newly founded Electronic University. The importance of research is emphasized, and activities sponsored by the Office of Educational Research and Improvement (OERI) which contribute to research are described. These activities include the sponsoring of a conference on computer research needs in basic skills in November 1982 and the awarding of a grant for the Center for Technology, which will focus on research; establishing the National Diffusion Network (NDN) to identify and designate schools using technology successfully as "lighthouse schools," disseminate knowledge of successful technological programs, and assist other schools in implementing such programs, which currently include programs in occupational training for secondary students, records management, and improving mathematics and reading skills; the awarding of grants for 12 school-based technology demonstration sites to facilitate sharing of programs with other school districts, including training programs such as Projects BEST, SLATE, and VIM and programs for teaching physics, chemistry, writing, mathematics problem solving skills, writing skills, and computer literacy; using educational television through such programs as the "Voyage of the Mimi" and "3-2-1 Contact"; and monitoring contracts to use technology to improve teaching of basic skills in mathematics, science, and writing, including project Quill, which uses the microcomputer to help teachers teach writing to third- through sixth-grade students. (DJR)

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ED298883

"Technology: Developing Our Newest and Greatest Resource"

by
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Delivered at
National Conference on Technology and Education
Fort Worth, Texas

April 19, 1984

IR012349

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Good Morning.

I am delighted to be a part of this very exciting National Conference on Technology and Education. I have had a chance to review your program and I know that you are going to be hearing about and discussing some very important and timely topics with some of the leading experts in the field present. I wish you well in your endeavors. I wish to commend the College of Education at the University of Texas at Austin and Tandy Corporation/Radio Shack for sponsoring this outstanding conference.

Probably, the greatest dilemma facing educators today is trying to determine what the world of work will be like as few as 15 or 20 years hence. One of the functions of the schools is to prepare the young people of our nation today to become responsible members of society tomorrow. An essential part of that function includes preparing them with a means for earning a living. The schools must be prepared to train, or at least ready for training, future job holders.

Today, that is not a simple task. The job market of the future, even the near future, is not as easy to estimate or predict as it once was. Obviously, there has always been some difficulty in being precise as to occupational opportunities and needs. Consequently, there have been times when we have had too many engineers and/or not enough nurses and too many teachers of English and not enough teachers of mathematics. These difficulties, however, have been temporary, and one cannot say they are due to improper career and professional guidance by the schools. As the supply and demand nature of the job market applied itself to these situations, these temporary problems disappeared in a relatively short period of time.

The problem we are facing today, however, is not so precisely delineated nor is it going to be so simply solved. In fact, not only can we not predict demand in certain job areas, we do not even know what some of the jobs of the future decades will be. Some jobs which exist now will soon be eliminated while other jobs loom on the horizon waiting to be developed. It is difficult to prepare an individual for a career that at this time is not even visualized or may depend on certain unforseen developments in other fields.

To further complicate matters, it is most likely that this shifting pattern of job and/or career needs will continue. Up to almost the present decade, the education and training which one took in preparation for a career would prepare that individual, with perhaps only occasional updating, for a lifetime in that career. This is, quite simply, no longer the case. It is estimated that training for many careers, in the near future, will last only 10 to 15 years. A large segment of the population is going to need a career "re-training" every 10 to 15 years. We may need to prepare individuals for three or four career changes during a lifetime.

What this presents to educators is both a challenge and a dilemma. Somehow, while many were unaware that it was happening, we have stepped out of our present "industrial age" and over the threshold into the "information age." The information age, and its adjunct to the computer, is here---now! Nobel prize winner and University Professor at Carnegie-Mellon University, Dr. Herbert A. Simon has placed the development of the computer in this perspective in a speech before a conference

of educators in November of 1982 (Computers in Education: Realizing the Potential, Washington, D.C.: GPO, 1983, Volume II):

> Nobody really needs convincing these days that the computer is an innovation of more than ordinary magnitude, a one-in-a-several-centuries innovation and not a one-in-a-century innovation or one of these instant revolutions that are announced every day in the papers or on television. It really is an event of major magnitude.

And it is an event that will affect not only the way we earn our living but the way we live as well. Dr. Marvin Cetron, who has forged a career by providing research and realistic forecasts of the future for governments, businesses, and interested individuals, listed in International and Occupational Forecasting what he considered to be the "Hot fields for 2000 and beyond". The top three he cites are:

- o Telemarketing (sales) workers
- o CAD/CAM workers (computer-aided design and manufacture)
- o Software writers

We must prepare now to offer programs in the schools that will prepare students to be functioning, literate members of an information-based society, and to provide them with the tools necessary to keep and hold a job in such a society.

We are living in the age of technology. This means that we can utilize technology to improve our way of life, and the way in which we perform our jobs. It does not mean, however, that all new jobs will necessarily be high-tech jobs.

What it does mean is that there is a need for better education by our schools, and that there is a growing need for more and better

educational opportunities after the completion of what we refer to as a "formal" education. Adult re-education is, and will continue to be, a growing facet of the educational picture.

The computer, as well as other technological innovations, can provide us with a means of offering improved educational opportunities, in a cost effective manner. A case in point is the newly founded Electronic University, a private enterprise venture. The electronic university is an innovation which enables anyone, anywhere in the world to have an opportunity for learning.

Interactive in nature--the learner is able to communicate with the instructor--it offers educational opportunities of a wide ranging nature. An interested student purchases a "knowledge package" which enables the owner to sign-up for a number of courses. The fee includes the "electronic lectures," telephone charges, and network transmission charges; students will receive from the teacher the text of lectures and graphics to accompany them, as well as the opportunity to exchange messages (questions, test results, etc.) with the teacher through electronic mail.

This concept when fully implemented will offer educational opportunities to many who have not had them in the past or at least were hampered in their educational advancement for a variety of reasons--for example: individuals with physical handicaps, people confined to specific location such as a prison or nursing home, and persons residing in geographically remote areas.

The services provided by the electronic university can be performed in a cost effective manner. It is an ideal resource for the re-training of an adult in need of re-training. For example, imagine a farmer who wants to learn about a new farming technique. In the past he might have to travel hundreds of miles to receive the training but the time and expense of such an endeavor would probably cause him to forego what could be valuable training and information. The electronic university can provide him with the means for his training with no travel and at a time to suit his own convenience.

Or, individuals who work an erratic or off-hour schedule, and who would not be able to attend regular classes, can now receive the training or re-training they need from a "live" professor with whom they can have two-way communications. The possibilities are limitless and quite exciting.

Traditional schools need to get into the act as well. This is not to say that everyone needs to be a computer expert or that everyone in the future will spend the bulk of their time on the job in front of a word processor. What it does mean is that we have available to us new technologies that enable us to improve education.

Educators must not be so awed by this fact that they are overwhelmed into a lack of action. There is no point in waiting until we can do things perfectly before we do them at all. Now is the time to get started. One of our biggest assets can be research; it can lead the way. Educators can benefit from new knowledge provided by research.

Toward this end the Office of Educational Research and Improvement convened a group of forty top experts at a conference held at Carnegie-Mellon University and the University of Pittsburgh in November of 1982. The conference was an exceptional experience as these leading scholars explored the key research areas needed in using computers in mathematics, science, reading, and writing. The report, Computers in Education: Realizing the Potential has already become a major document for identifying research into instructional technology.

Also, through the National Institute of Education, we have granted an award for a Center for Technology that will focus on research.

Schools can also learn from one another through the sharing of information and ideas. Allow me to highlight some of the work of the Office of Educational Research and Improvement which contributes to the notion of sharing in the field of technology.

The National Diffusion Network identifies exemplary programs and assists school districts to adopt and implement these exemplary programs. It utilizes the knowledge of successful programs which can be used in other areas to bring information of good educational practices to other school districts and to avoid duplication of effort. We've been able to use the NDN network very effectively in assisting the technological revolution in our educational system.

First, the Secretary of Education, who has the authority to define areas of concentration for NDN, listed technology as one of the fourteen priority areas. In this list of priorities, attention will be given for computer science programs which aim to help students (1) understand the computer as an information, computation, and communication device;

(2) use the computer to enhance instruction in English, mathematics, science, social studies, or for personal and work-related purposes, or (3) understand the world of computers, electronics, and related technologies.

Second, the Secretary designated that a number of schools utilizing technology successfully should be designated by the NDN as "lighthouse schools." These schools receive extra funding to train other educators with the expectation that their experience will be replicated in other parts of the country. The response has been enthusiastic and satisfying. We now have ten "lighthouse" schools so designated with programs ranging from alternative occupation training in high technology for secondary school age students (some of whom had previously been high school dropouts) to more effective management of student records to using technology to improve math and reading skills.

An exciting new program announced late last year, and one which has been received with much enthusiasm, provided grants to twelve school-based technology demonstration projects. The funds for these grants were provided by the Secretary's Discretionary Fund. Schools were asked to identify a learning objective and devise a means where one or more technologies were used to accomplish an educational objective.

While most educators are excited about the use, and possible uses of technology, both in and out of the classroom, there has been a limited attempt to realize the full potential. The school-based demonstration projects provide good examples to follow. Through this program, we have identified excellent programs being offered, and

utilized successfully, in many localities throughout the nation. This program is designed to facilitate the sharing of the best of these programs with other state and local school districts. The ultimate goal is the widespread improvement in the use of technology for educational purposes.

In announcing the awards for these projects, which together totalled more than 1.5 million dollars, U.S. Secretary of Education, Terrel H. Bell said:

> The demonstrations by the selected schools will help answer many questions concerning the use of technology in the classroom. These outstanding projects will serve as excellent examples of how to use microcomputers and other electronic devices in striving to achieve excellence in education.

The demonstration sites are distributed throughout the United States: urban, suburban, and rural school districts are all represented.

Somewhat innovative in terms of grant programs--grant awards to local schools is a new approach for the Department--some examples of the high quality programs which were selected for grant awards are:

- the use of interactive technology to upgrade the knowledge and skills of physics teachers and, simultaneously, deliver high-quality physics instruction to students. This program is located in Iowa and will involve the University of Northern Iowa in Cedar Falls working with 45 secondary schools.

- already noted for their innovative school/industry partnership, the Digital Equipment Corporation and the Lynnfield and Lexington, Massachusetts public schools will expand upon their cooperative efforts in the training of teachers to teach physics and chemistry. The schools will be assisted by Digital's IVIS system. Teachers will be trained to develop more software for use with the system.

- o Also located in Massachusetts, the Network, Inc., will combine with three local school districts in a program designed to utilize the computer in the teaching of writing to students at the secondary level.

- o In Virginia, the Fairfax County Public Schools will use an extensive array of micros to extend computer-assisted instruction to the upper grades. Examples include: teaching math/problem solving in grades 5 to 8 and science in grades 9 to 12. Further, they are going to add word processing to their curriculum in grades kindergarten through 12. They will also provide additional teacher training in the use of microcomputers.

- o The Houston, Texas Independent School District will develop and disseminate technology-based programs in several areas, including computer literacy. Six public and one private high school will be involved.

Other school districts which will be involved include: all Coeur d'Alene, Idaho elementary and secondary schools; the University of Arizona, Tucson and the Glazier Elementary School at Norwalk, California; Western Kentucky University, Bowling Green and 10 middle schools in a consortium of 23 school districts; Montclair, New Jersey Board of Education with 6 elementary, 2 middle, and 1 high school participating; WICAT Education Institute, Provo, Utah will work with 3 schools in Provo, 1 school in Port Hueheme, California and 1 school in a big Eastern city school system; and the Educational Communications Board, Madison, Wisconsin will involve all their local education agencies and all elementary schools in the state of Wisconsin.

These projects will be effectively monitored and reports prepared on what we have learned. These will be widely disseminated.

OERI has provided training for thousands of State and local leaders in technology through such programs as Project BEST, Project SLATE, and Project VIM.

We are also using technology, educational television, to teach science through such programs as the "Voyage of the Mimi" and, in cooperation with the National Science Foundation, "3-2-1 Contact".

We are monitoring several contracts to utilize technology to improve the teaching of basic skills in the area of mathematics, science and writing. One of these is a unique communication program known as Project Quill which uses a set of microcomputer-based programs around which several instructional activities have been developed. The activities are geared to young writers in grades 3 to 6. Quill utilizes the microcomputer's technological capabilities to help teachers teach writing. The youngster's natural enthusiasm for anything connected with the computer strongly motivates them to write and to perform the various tasks which are a part of the program. It has helped to eliminate the drudgery of rewriting compositions by hand. Corrections and rewrites can be made quickly on the word processor and a print-out secured. The computer is being used to help students to write better, not as a replacement for the skill of writing.

Textbook publishers can also take a leadership role in helping schools to make the most of computer usage in their educational programs by developing appropriate educational software.

Improving the technological perspective of the schools is very much going to be a cooperative effort in all aspects of the endeavor.

Sylvia Charp, Editor-in-Chief of T.H.E. Journal points out in the April, 1984 issue:

> Thought must be given before buying equipment as to what will be done with the equipment, and whether there will be a need for it to become part of a network. There now

exists a choice. Computers and peripherals for networking and communications will become increasingly important in education and in industry as manufacturers, software developers, publishers and educators work together to provide economical and effective telecommunication devices and systems.

Of course, we must be mindful of the fact that no matter what other programs or initiatives we might attempt to implement in the educational arena, we must not ignore basic education.

A few years back, critics viewing problems in education posed the question "Why Can't Johnny Read?' Professor Eric Zorn updated the education crisis in an article in the Chicago Tribune (August 12, 1981) when he related this problem to the technology age. His article was entitled "If Johnny Can't Read, How Will He Plug In To The Electronic World?" He wrote:

> You can call him Johnny: long-suffering mascot of national illiteracy; standard bearer of our collective disgrace; blot on Western culture.
>
> He still can't read very well, his writing is getting worse, and he's about to be victimized by one of the most dramatic undertakings in the history of civilization: the Information Revolution, a watershed in human development to compare with the Industrial Revolution 150 years ago and the invention of the printing press in 1440.
>
> During the projected Information Revolution of the next 20 years, Johnny will be overrun by those marching to the muted, staccato drumbeats of clicking electronic keyboards.
>
> The common person supposedly will have access to the equivalent of 10,000 mental slaves. Money will be made and business conducted by buying, selling, and trafficking in information and its complicated delivery systems.
>
> The already evident truth will become more obvious: Power, for individuals and nations, is knowledge.
>
> Where will that leave Johnny, the person who does not have a functional ability to read or write any language?
>
> He will find that there are fewer jobs for unskilled workers. His world will be highly complex and interconnected, and daily life will demand control of sophisticated cable and computer technology; he will be unable to take advantage of this vast technology with his so-so-skills.
>
> Self-styled experts will speculate endlessly "Why Johnny Can't Log on."

His prognosis is an apt one. Without a concern for, or a conscious attempt to have excellence in education, other efforts will be futile.

It is important that we develop our human resources to the best extent possible for our survival as a nation. We have seen documented the decline of U.S. school standards since the early 1960s: class grades have remained up but real performance has gone down. Dr. Barbara Lerner has noted that this has occurred in a period where we have sent more of our young people to school for longer periods of time than any other nation in the world. American productivity has also declined during this period. Dr. Lerner warns that the U.S. might face the period where high level managerial, professional and scientific talent will be in short supply and consequently the U.S. may discover this situation bringing serious economic, political and social problems.

Perhaps the significance of the challenge we face in learning was best stated by Columbia University professor Diane Ravitch in her recent work The Troubled Crusade: American Education 1945-1980. Dr. Ravitch notes:

> To believe in education is to believe in the future, to believe in what may be accomplished through the disciplined use of intelligence, allied with cooperation and good will. If it seems naively American to put so much stock in schools, colleges, universities, and the endless prospect of self-improvement and social improvement, it is an admirable, and perhaps even a noble flaw.

And finally, the U.S. must once again regain confidence in its ability to grow and expand and develop. During the 1960s and 1970s we experienced in our public life advocates of limited growth and limited development, a philosophy leading to lack of confidence in ourselves and

our society and a malaise prevalent in our institutions of higher education. The late Herman Kahn, in his last book The Coming Boom, observed that one of the reasons he expected high and sustained growth rates through the 1980s and 1990s was because of a whole host of new technologies and technological improvements ripe for large-scale exploitation, notably computer networks.

The electronic learning, growing more and more popular, builds upon these amazing developments in society, in learning and in opportunity. The technology is here; the will to use it effectively must also be present.

I should mention that we need to be aware of the disadvantages or limits on this breakthrough--educators unwilling to change may resist; special interests may lobby vigorously against it fearing it will replace teachers; competitors may undermine it for their personal interest; and an apathetic public may fail to respond; quality of courses may be compromised in seeking a greater quantity of students; equalitarians may be dissatisfied with opportunities for access.

However, we need to recognize the great advantages--electronic learning can give greater access, more extensive educational opportunities, and an enhanced relationship between teachers and students; this development requires no knowledge of technology except the ability to push buttons; expansion of education is related to the declining cost of technology; a great educational system can further expand developing a more knowledgeable population and informed worker and consumer. An expanded and better educated population can assist American productivity at home, and American leadership in the world.

All of you gathered here can play a vital role in this next stage of development for technology and education. As John Naisbitt writes in his final statement in Megatrends: "My God, what a fantastic time to be alive!"